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# Hardiness and Productiveness of U. S. No. 5 Refugee Snap Bean in the Southern United States<sup>1</sup>

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## INTRODUCTION

In the fall of 1935 the U. S. No. 5 Refugee, a mosaic-resistant bean of the stringless Green Refugee type, was released to the seed trade by the United States Department of Agriculture. At the time of the release it was believed that this bean was valuable principally for canning. In 1938 Wade and Zaumeyer<sup>2</sup> described the variety and gave data on its performance as a canning variety. Since that time it has been found that U. S. No. 5 Refugee is very hardy and productive under southern conditions. The purpose of this circular is to present the evidence for hardiness as found at Charleston, S. C., and some pertinent notes from other agencies.

## METHODS AND MATERIALS

The size of plot (single 32-foot rows, 3 feet apart) has remained constant throughout all tests. This size is very convenient, since the yield in grams per plot equals numerically the calculated yield in pounds per acre. In the spring of 1936 a few rows of several bean varieties were planted late in the season for observation. In 1937

<sup>1</sup> This work was performed under an allotment from the Special Research Fund authorized by Title I of the Bankhead-Jones Act of June 29, 1935.

<sup>2</sup> WADE, B. L., and ZAUMEYER, W. J. U. S. NO. 5 REFUGEE, A NEW MOSAIC-RESISTANT REFUGEE BEAN. U. S. Dept. of Agr. Cir. 500, 11 pp., illus. 1938.



and 1938 date-of-planting tests were conducted, using the Stringless Black Valentine as the standard variety. Duration-of-picking trials were conducted in 1939 and 1940 and a defoliation experiment in 1940.

The records on the defoliation test were taken on a single-plant basis. In all except the defoliation experiment the 2 varieties were planted in paired rows replicated 10 times each, and variance analyses of the data were made. As U. S. No. 5 Refugee is approximately a week later in maturity of snap pods than is Stringless Black Valentine, some plantings were made so that pods of the 2 varieties would mature at the same time; in other plantings both made at the same time, there was in most cases approximately a week's difference between them.

In the defoliation tests Bountiful and VBL 19, both maturing with Stringless Black Valentine, were used also. VBL 19 is a wax-pod, early strain related to U. S. No. 5 Refugee, and it possesses some of the same hardness characteristics.

Western-grown seed of Stringless Black Valentine was used in all tests, but locally grown seed of U. S. No. 5 Refugee was used in all except the preliminary test in 1936.

Planting rates were approximately 50 pounds per acre for Stringless Black Valentine and 25 pounds per acre for U. S. No. 5 Refugee. In general, good stands were obtained. Considering seed size this planting rate represented about 65 percent as many seed of U. S. No. 5 Refugee seed as of Stringless Black Valentine. This planting rate for Stringless Black Valentine was decided upon, as it is approximately the prevailing local rate for that variety and because the South Carolina Truck Experiment Station at Charleston, S. C., had confirmed<sup>3</sup> the work of Miller and Kimbrough<sup>4</sup> on desirable rates for seeding snap beans. The rate for U. S. No. 5 Refugee was decided upon after it was found that rates above 30 pounds per acre seriously reduced the yields of this variety.

In the defoliation test the seeds were planted 4 inches apart and the plants were thinned to 12 inches apart within 4 weeks. By having a large number of plants available for defoliation, it was possible to have plants uninjured by any agency for comparison at the end of the season. In the defoliation test leaves were removed shortly after they appeared.

U. S. No. 5 Refugee and VBL 19 are semi-indeterminate in growth habit with many relatively small leaves, whereas Stringless Black Valentine and Bountiful are determinate in growth with few and relatively large leaves. This is shown for U. S. No. 5 Refugee and Stringless Black Valentine in figure 1.

The pods of U. S. No. 5 Refugee average about 5 inches long for well-grown specimens, but those of Stringless Black Valentine are 1 to 2 inches longer. Those of U. S. No. 5 Refugee approach roundness in cross section, whereas those of Stringless Black Valentine are variably oval. This is shown in figure 2.

<sup>3</sup> Unpublished results.

<sup>4</sup> MILLER, JULIAN C., and KIMBROUGH, W. D. BEAN INVESTIGATIONS. La. Agr. Expt. Sta. Bul. 245, 10 pp. 1933.



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## U. S. NO. 5 REFUGEE SNAP BEAN

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FIGURE 1.—Plants of U. S. No. 5 Refugee (A) and of Stringless Black Valentine (B). Note the small and abundant leaves of the former compared with the larger, less numerous leaves of the latter. About 12 leaves were removed from the former and 3 or 4 from the latter to give a better view of the pods.



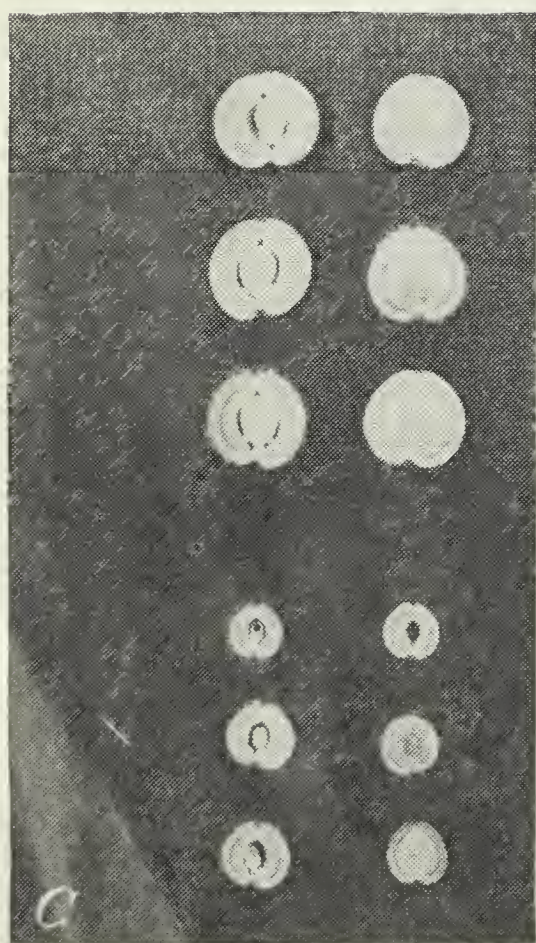


FIGURE 2.—Pods of U. S. No. 5 Refugee (A) and of Stringless Black Valentine (B). Note that those of the former are small, nearly round, and light, and that those of the latter are large, oval, and dark. Cross sections of 4 various-aged pods of U. S. No. 5 Refugee (C) and of Stringless Black Valentine (D).



## EXPERIMENTAL RESULTS

In 1936 the information gained was purely from observations. Because of the ravages of bean beetles the figures obtained were too variable for use. In subsequent years insects were controlled and consistent results were obtained. From the observations of 1936 it was evident that U. S. No. 5 Refugee was hardy and, if planted late in the season, would set pods when varieties commonly used in the area and other strains of Refugee would set few or no pods.

The results for 1937 and 1938 are given in table 1. Beans are ordinarily planted in the Charleston area from March 25 to April 15. After this later date they are seldom planted for a spring or summer crop, because most varieties when planted later seldom yield sufficiently high to justify the operating costs. In 1937, U. S. No. 5 Refugee and Stringless Black Valentine were planted on April 30, May 17, and May 28. For the first planting Stringless Black Valentine yielded an average of 1,277 pounds per acre and U. S. No. 5 Refugee, 4,557. Both varieties gave reduced yields for the second and third plantings. The yields for the third planting were 133 pounds for Stringless Black Valentine and 2,364 for U. S. No. 5 Refugee. The first picking from Stringless Black Valentine planted on April 30 was made on June 12 and that from U. S. No. 5 Refugee from the same planting date was on June 19, but both varieties planted on May 17 were ready for picking on July 29, and both varieties planted on May 28 were ready for picking on August 12. The first planting yielded four pickings for each variety, but the second and third plantings each gave only two pickings for Stringless Black Valentine and four for U. S. No. 5 Refugee. In every case U. S. No. 5 Refugee outyielded Stringless Black Valentine by such a high margin that refined statistical methods are hardly needed to judge this difference significant.

In 1938 two plantings were made of U. S. No. 5 Refugee and Stringless Black Valentine on May 19 and June 1. The results paralleled those of 1937. U. S. No. 5 Refugee gave four pickings for each planting, but Stringless Black Valentine planted on May 19 gave only the first two pickings and that planted on June 1 gave only the first and fourth pickings. The average yields for the May 19 planting were 404 pounds of Stringless Black Valentine per acre and 2,983 of U. S. No. 5 Refugee; for June 1, they were 130 and 2,203, respectively. These differences are statistically significant.

In 1939 and 1940 a study was made of duration of picking after planting the beans at as early a date as field conditions permitted. In 1939 the main planting was made on March 24 with three check plots of Stringless Black Valentine planted on March 31. In 1940 U. S. No. 5 Refugee and two check plots of Stringless Black Valentine were planted on March 25 and the regular plot of Stringless Black Valentine was planted on April 1. In both years Stringless Black Valentine gave only four pickings and U. S. No. 5 Refugee gave six (table 2). Whether the yields of the four pickings of Stringless Black Valentine are compared with six or with four U. S. No. 5 Refugee pickings, the latter significantly outyielded it.

TABLE 1.—Effect of date of planting on yields of Stringless Black Valentine in comparison with those of U. S. No. 5 Refugee in 1937 and 1938

Year and variety		Date planted		First picking		Second picking		Third picking		Fourth picking		Total yield	Difference
				Date	Yield	Date	Yield	Date	Yield	Date	Yield	Pounds	Pounds
1937					Pounds		Pounds		Pounds		Pounds		
Stringless Black Valentine		Apr. 30		June 12	432	June 16	658	June 21	145	June 25	42	1,277	3,280
U. S. No. 5 Refugee		do		June 19	923	June 23	1,444	June 28	1,286	July 2	904	4,557	
Stringless Black Valentine		May 17		July 29	59	Aug. 4	67	Aug. 10	0	Aug. 16	0	126	2,844
U. S. No. 5 Refugee		do		do	855	do	794	do	816	do	605	3,070	
Stringless Black Valentine		May 28		Aug. 12	52	Aug. 18	81	Aug. 25	0	Aug. 31	0	133	2,231
U. S. No. 5 Refugee		do		do	616	do	515	do	651	do	582	2,364	
1938													
Stringless Black Valentine		May 19		July 25	216	Aug. 1	188	Aug. 8	0	Aug. 15	0	404	2,579
U. S. No. 5 Refugee		do		do	929	do	881	do	637	do	536	2,983	
Stringless Black Valentine		June 1		Aug. 11	63	Aug. 17	0	Aug. 24	0	Aug. 30	67	130	2,073
U. S. No. 5 Refugee		do		do	501	do	507	do	555	do	640	2,203	

TABLE 2.—Duration of picking and yield of Stringless Black Valentine in comparison with those of U. S. No. 5 Refugee in 1939 and 1940

Year and variety		Date planted		First picking		Second picking		Third picking		Fourth picking		Fifth picking		Sixth picking		Total yield	Difference
				Date	Yield	Date	Yield	Date	Yield	Date	Yield	Date	Yield	Date	Yield	Pounds	Pounds
1939					Pounds		Pounds		Pounds		Pounds		Pounds		Pounds		
Stringless Black Valentine		Mar. 24		May 20	585	May 24	2,789	May 29	1,851	June 1	537	June 9	879	June 12	820	5,762	3,958
U. S. No. 5 Refugee		do		May 26	674	May 29	3,258	June 1	3,135	June 5	954	do	do	do	do	9,720	
Stringless Black Valentine		Mar. 31		do	656	do	2,975	do	1,787	do	553	do	do	do	do	15,972	
1940																	
Stringless Black Valentine		Apr. 1		May 29	555	June 3	2,741	June 7	2,002	June 10	494	June 12	887	June 15	781	5,792	3,621
U. S. No. 5 Refugee		Mar. 25		do	602	do	3,253	do	2,949	do	941	do	do	do	do	9,413	
Stringless Black Valentine		do		May 22	515	May 25	2,825	May 29	2,450	do	413	do	do	do	do	26,203	

<sup>1</sup> Average of 3 plots.

<sup>2</sup> Average of 2 plots.



In 1940 a study was made of partial defoliation to determine the ability of four varieties to recover from injury; the recovery was measured by leaf production and yield of pods per plant. The results of this study are shown in table 3. Partly defoliated plants of Stringless Black Valentine and Bountiful yielded significantly less than their respective nondefoliated checks, whereas those of U. S. No. 5 Refugee and VBL 19 yielded slightly less than their checks but not significantly so. U. S. No. 5 Refugee and VBL 19 when partly defoliated produced significantly more leaves or leaf traces than the corresponding checks, whereas Stringless Black Valentine and Bountiful produced slightly fewer leaves than their checks.

TABLE 3.—*Effect of partial defoliation on yields of four varieties of snap beans, 1940*

Variety	Treatment	Date planted	Leaves or leaf traces per plant on June 25 <sup>1</sup>	Duration of picking period	Average yield per plant	
					To June 10	For all pickings <sup>2</sup>
			Number		Grams	Grams
Stringless Black Valentine.	{Defoliated	Apr. 1	20	May 29 to June 10	81	81
	{Nondefoliated	do	23	do	93	93
U. S. No. 5 Refugee	{Defoliated	Mar. 25	36	May 29 to June 25	115	164
	{Nondefoliated	do	30	May 29 to June 18	145	170
Bountiful	{Defoliated	Apr. 1	18	May 29 to June 10	89	89
	{Nondefoliated	do	22	do	97	97
VBL 19	{Defoliated	do	32	May 29 to June 20	123	158
	{Nondefoliated	do	27	May 29 to June 15	139	161

<sup>1</sup> Difference between treatments required for significance, 4 leaves.

<sup>2</sup> Difference between treatments required for significance, 7 grams.

## RESULTS OBTAINED BY OTHER AGENCIES

The Tennessee Agricultural Experiment Station has perhaps made the most extensive trials of U. S. No. 5 Refugee of any State agency in the South. Strand<sup>5</sup> stated that U. S. No. 5 Refugee is highly productive under Tennessee conditions, especially when planted in late July or early August. It required from 10 to 12 days longer to mature than other varieties, such as the stringless green pods. The blossoms set during hot and comparatively dry weather. For a 4-year mean yield, 1938–1941, inclusive, from late July and early August plantings, Strand obtained for U. S. No. 5 Refugee 2,636 pounds per acre and for Asgrow Stringless Green Pod 1,260 pounds. In regard to the fall crop of 1941, he stated that Asgrow Stringless Green Pod yielded 469 pounds per acre, Full Measure 226, U. S. No. 5 Refugee 1,372, U. S. No. 5 Refugee selection 1,530, and one of the strains from the United States Regional Vegetable Breeding Laboratory derived from a U. S. No. 5 Refugee cross, 1,938 pounds. The 1941 season was especially dry.

In correspondence, H. T. Cook of the Virginia Truck Experiment Station reported that they have had small tests of U. S. No. 5 Refugee in trial plots for the last 3 or 4 years but have not had a sufficiently large planting to get accurate records on its yield and general type. These tests, however, indicate that the U. S. No. 5 Refugee is resistant to powdery mildew and to rust under Norfolk conditions. It was

<sup>5</sup> STRAND, A. B. BEAN AND CORN VARIETIES FOR CANNING. Tenn. Agr. Expt. Sta. Cir. 51. 8 pp. 1940. [Processed.]



affected with halo blight, but, as C. F. Andrus has pointed out, it is probably resistant to this disease to a certain extent because of its abundant foliage. In a number of their tests the U. S. No. 5 Refugee has set pods very heavily, which indicates that it would be a good yielder. It has also been somewhat resistant to moderate frosts early in the season because of the abundant foliage and the production of the pods on the inside of the plant, but heavy frosts have killed the plant completely.

J. C. Miller of the Louisiana Agricultural Experiment Station stated that U. S. No. 5 Refugee has done exceptionally well at Baton Rouge in both fall and spring, and it has been found very compact and prolific. He has shown this variety to a number of growers, and the only criticism that they offered is that the pods are a bit shorter than the accustomed varieties. He sees no serious objection to this character.

H. B. Corder of the Oklahoma Agricultural Experiment Station wrote that the climate in central and western Oklahoma favors early-maturing snap bean varieties since the season may be shortened by a deficiency of moisture. In the trials conducted on the station farm, near Stillwater, Okla., the variety Bountiful has been most productive in unirrigated plantings. However, in duplicate irrigated plantings, the U. S. No. 5 Refugee and Giant Stringless Green Pod, which are later but potentially more productive than Bountiful, have yielded best.

The U. S. No. 5 Refugee has come into production a few days later than Giant Stringless Green Pod in the tests at Stillwater, Okla., but in irrigated plantings it has produced highly satisfactory yields. From these results it appears that it could be grown successfully in the more humid eastern and southeastern parts of the State and, when irrigated, would do well in other sections. At present, the variety is not widely planted, but because of the high quality and the fine appearance of the canned beans, it is being recommended to gardeners in those sections where successful production is possible.

L. R. Farish of the Mississippi Agricultural Experiment Station wrote that from the reports they have from the substations of that State they conclude that U. S. No. 5 Refugee is rather hardy and productive in that State, and the yields at Crystal Springs for 1939 and 1941 were greater for the U. S. No. 5 Refugee than for the Black Valentine, but not as great as for the Bountiful. The shippers in that area, however, were prejudiced against the U. S. No. 5 Refugee as a market bean. It seems that they just do not desire a bean of this type, but the behavior of the bean itself was rather favorable in that State and it seemed to stand up better under dry weather conditions than most of the other varieties of bunch beans.

The Alabama Agricultural Experiment Station reported that U. S. No. 5 Refugee has been grown by them only once and that was in the spring of 1941. They had an unusually dry growing season and at one time thought that the bush beans were a complete failure, but the rain finally came and several varieties produced a fair crop.

U. S. No. 5 Refugee produced more beans than any commercial variety in the planting except Refugee 1,000:1, but the difference was not significant with several varieties. The results were analyzed by the analysis of variance, and U. S. No. 5 was significantly better than Asgrow Stringless Green Pod, Tennessee Green Pod, Early Refugee, and



Asgrow Stringless (Black) Valentine at the 1-percent level. It was significantly better than Bountiful at the 5-percent level.

J. F. Wood of Texas Substation No. 15, Weslaco, wrote that the yields have not been as high on the Refugee types as on the stringless green pod types. A number of canners preferred the Refugees. In the small test that was conducted with various snap beans, it was noticed that all the Refugees are more tolerant to bean leafhopper damage than the other types. No yield data were given.

Ada C. Howard of the Farm Security Administration, Knoxville, Tenn., has found U. S. No. 5 Refugee satisfactory for summer plantings in trials with many families. She stated that the seed packages sponsored by the Extension Service include it. She suggested that the families would get better results if they did not plant this variety at such a heavy rate as they are accustomed to use for other varieties.

A. M. Musser, writing from the South Carolina Agricultural Experiment Station, Clemson, S. C., stated that U. S. No. 5 Refugee grown there in the fall of 1941 did very well under rather adverse conditions. It was grown on bottom land which was not as dry as hill land, but drought was extreme and the beans were not irrigated.

Robert Schmidt of the North Carolina Agricultural Experiment Station wrote that the only section of the State in which they have tried U. S. No. 5 Refugee is in the mountain area. It did very well there when compared with Tendergreen or any of the stringless varieties. Comparisons have not been made except by observation.

Bountiful is rapidly disappearing as a shipping bean in the South, but there are many indications that it possesses considerable yielding ability. Consequently, there may be some interest in a comparison of yields of Bountiful with those of Stringless Black Valentine. The South Carolina Truck Experiment Station at Charleston stated that in most years Bountiful yields slightly more than Stringless Black Valentine, but the difference is seldom significant. For 1934 Bountiful averaged 5,712 pounds per acre and Stringless Black Valentine 4,838, with a difference required for significance of 509 pounds, while in 1935 the comparisons were 6,310, 6,048, and 582 pounds, respectively. A few years ago the South Carolina Truck Experiment Station discontinued the growing of Bountiful in its trials.

## DISCUSSION

During the last 10 years Stringless Black Valentine has become the most important snap bean variety in the southern United States. At least 50 percent of the acreage planted to beans in the southern United States is planted to this variety. Under some conditions it has given low yields and in a few cases crop failures. In seven paired tests in comparison with U. S. No. 5 Refugee from 1937 to 1940 covering the usual planting season and also the hot summer season when snap beans are not ordinarily produced at Charleston, S. C., or over much of the South, U. S. No. 5 Refugee has consistently outyielded Stringless Black Valentine. During the summer season U. S. No. 5 Refugee has given at least fair yields when the crop from Stringless Black Valentine has been very small or approaching failure.

U. S. No. 5 Refugee has been successful as a canning variety, and large acreages are now planted for this purpose in New York and other States. The writer has no adequate record of this bean's having



been used for canning in the South, but the record herein of its production would indicate that satisfactory yields could be obtained. Several hundred acres of U. S. No. 5 Refugee are now being grown in southern Texas for canning.

Two objections have been raised to U. S. No. 5 Refugee for canning: (1) It is slightly lighter green in pod color than mosaic-susceptible Refugees; and (2) it has been reported as slightly more susceptible to bacterial blights.<sup>6</sup> However, if a canner wishes to can U. S. No. 5 Refugee with exactly the same degree of greenness as some slightly darker Refugee, all that is necessary is to decrease the blanching time by a few seconds; and there is the additional advantage that shorter blanching time is probably associated with less loss of vitamin C.<sup>7</sup>

At Charleston under epidemic blight conditions in which Stringless Black Valentine, Bountiful, and other varieties have been severely injured, U. S. No. 5 Refugee has remained relatively uninjured. U. S. No. 5 Refugee produces many more leaves than Stringless Black Valentine or Bountiful, and if leaves are removed from it they are replaced much more readily than are those of Stringless Black Valentine or Bountiful. In New York and certain other States where U. S. No. 5 Refugee has been grown on a large scale, there have been no reports of serious damage from bacterial blights. In Wyoming, however, in 1941 it was seriously damaged by halo blight when inoculated artificially. Observations at Charleston lead to the belief that under epidemic blight conditions in the South U. S. No. 5 Refugee can be counted on to produce a commercially satisfactory crop. Bacterial blight lesions have never been observed on pods of U. S. No. 5 Refugee at Charleston, but in most seasons they are abundant on Stringless Black Valentine and Bountiful. Under irrigation in Wyoming in 1938 U. S. No. 5 Refugee was found least damaged by blights of the 19 strains and varieties observed, whereas on nonirrigated plots Full Measure and U. S. No. 5 Refugee were very slightly and about equally damaged.<sup>8</sup>

U. S. No. 5 Refugee has been grown for seed at Charleston since 1936 and usually produces two seed crops per year. A maximum of 0.5 percent of plants showing primary lesions of bacterial blights was found in the various crops from this locally produced seed. Stringless Black Valentine grown for only one generation locally has shown more than 4 percent with primary infection. Because of rains at harvest-time at many places in the South, the saving of the seed of U. S. No. 5 Refugee cannot be generally recommended. However, it might be desirable for the home gardener who can give special consideration to the harvesting of a small quantity of seed to harvest for this purpose.

One of the principal sources of damage to Stringless Black Valentine and Bountiful during epidemics of bacterial blights is the great amount of defoliation involved. U. S. No. 5 Refugee and VBL 19 may lose almost as many leaves as other varieties during such an epidemic, but the production of new leaves is so rapid that partial defoliation is not nearly so apparent. As indicated by the artificial defoliation results shown in table 3, Stringless Black Valentine and Bountiful possess very little ability to recover from defoliation, whereas

<sup>6</sup> ANDERSON, M. E. SENSATION REFUGEES. TWO NEW MOSAIC-RESISTANT VARIETIES. Canner 92 (7): 14-15. 1941.

<sup>7</sup> ADAM, W. B. THE NUTRITIVE VALUE OF CANNED VEGETABLES. (Digest) Canner 93 (15): 12-24. 1941.

<sup>8</sup> BABB, M. F., KRAUS, J. E., WADE, B. L., and ZAUMEYER, W. J. DROUGHT TOLERANCE IN SNAP BEANS. Jour. Agr. Res. 62: 543-553, illus. 1941.



the other two varieties recovered rapidly. Perhaps the real basis of tolerance of U. S. No. 5 Refugee and VBL 19 to bacterial blights is to be found in their semi-indeterminate growth habits and the correlated ability to produce leaves in abundance.

U. S. No. 5 Refugee appears to be resistant to attacks of powdery mildew. No damage attributed to this disease has been found during any growing season here, whereas Stringless Black Valentine, Bountiful, and many other varieties appear very susceptible, especially during the fall growing season.

As a market garden bean U. S. No. 5 Refugee has very high quality, hardiness, and heavy yields, but it is shorter and lighter green than Stringless Black Valentine. The latter has pods averaging from 1 inch to 2 inches longer. The main objection of shippers to U. S. No. 5 Refugee has been that its pods are too short and not deep enough in color, since the market is now used to a long dark-green bean. The best use of U. S. No. 5 Refugee for a market garden bean would probably be to supply local markets in the South when the less hardy, low-quality beans cannot be produced. Once consumers become accustomed to eating a high-quality bean, it seems improbable that they will continue to demand a fibrous although good-looking bean to which they had previously become accustomed.

The main use at present for U. S. No. 5 Refugee in the South would seem to be as a home garden bean on account of its hardiness. During the months of July, August, and September and parts of June and October snap beans are not available generally in gardens in the vicinity of Charleston, but they could be made available by growing U. S. No. 5 Refugee. In most parts of the South snap beans are not available during certain hot months, but they could be if this variety were used. In Tennessee and a few other places much use is being made of U. S. No. 5 Refugee as a home garden bean.

When it was discovered in 1936 that U. S. No. 5 Refugee was hardy in the South, crosses were immediately made with it or related lines on Stringless Black Valentine and other varieties grown in the South. From these crosses have been derived many earlier, green- and wax-pod hybrids possessing many of the hardiness characteristics of U. S. No. 5 Refugee. These hybrids are being given extensive trials in the southern United States, and it is believed that from them will come commercial strains of great value. The VBL 19 mentioned in this circular is a hardy, early U. S. No. 5 Refugee type with wax pods, suitable for canning or shipping in the South. Seed of VBL 19 is not yet available for gardeners and truck growers, but that of U. S. No. 5 Refugee is available from numerous commercial sources.

## CONCLUSIONS AND SUMMARY

In numerous yield tests U. S. No. 5 Refugee has consistently out-yielded Stringless Black Valentine, the dominant variety of the South at present. U. S. No. 5 Refugee and VBL 19, a wax-pod bean of a similar type, are able to recover from partial defoliation much better than Bountiful and Stringless Black Valentine. U. S. No. 5 Refugee appears to have sufficient tolerance to bacterial blights to produce a commercial crop, and it is also resistant to powdery mildew.

Differences in yield between U. S. No. 5 Refugee and Stringless Black Valentine are particularly noticeable during the hot, humid



summer months, when although the yields of the former are sharply reduced they remain on such a sufficiently high level that the variety may be used for home gardens or for growing for a local market; during the same hot, humid months Stringless Black Valentine produced so little as not to be worth while for such purposes.

The high quality and hardiness of U. S. No. 5 Refugee would seem to warrant more extensive use in the southern United States for canning, market-garden, and home-garden use.

Its limitations of pod size and light-green color have been fully recognized. Promising hybrids from U. S. No. 5 Refugee with Stringless Black Valentine and with other varieties are now being tried extensively by collaborating State experiment stations in the southern United States.